HASSELBLAD®

CLOSE-UP PHOTOGRAPHY

Close-up photography

Close-ups, a term evoking images of a world invisible to the unaided naked eye! Images that teach us much about the micro-world around us and provide insights into many of nature's processes. Taking close-ups is an important task for many photographers.

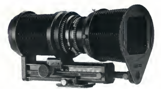
Their pictures can increase understanding and appreciation of the world in which we live. But close-ups can also serve other purposes. They are unvaluable adjuncts in science and technology. They can be used to record and document. They can also be used to make images available to many people of objects ordinarily visible only to the camera eye or some other optical device.

The close-up is also utilized for other types of subjects, as in fashion, advertising and even architectural photography, just to name a few fields. However, it is difficult to frame an unequivocal definition of what is meant by the term "close-up photography." Lens designers usually describe it as photography when the lens-to-subject distance is less than 20 times the focal length of the lens. A very broad definition devised to distinguish special-purpose close-up optics from ordinary lenses. Lenses especially designed for close-up photography have their optimum full-aperature working range at distances ranging from 20 times the focal length down to the closest focusing point. These lenses should be stopped down one step for the best results when employed for photography at long lens-to-subject distances. Photographers often define close-up photography as photography at lens-to-subject distances so short that the closest focusing point of the lens is exceeded and some close-up accessory becomes necessary. This definition is adequate for all practical purposes, even if it is not all-embracing. For example, it is meaningless for lenses with macro facilities. This booklet will mainly deal with close-up photography using some type of accessory.

Close limit of the eye

Both the human eye and the camera lens are restricted in their functions and have many shortcomings. A limited capacity for clear reproduction is one such shortcoming; another involves the wavelengths of light rays which can be converted into a usable image/picture. As we know, light is merely an extremely limited part of the electro-magnetic radiation encountered in nature.

The *distant limit* for sharp reproduction is, presumably, of no importance in this connection. But that is not so. Among other factors, the distant limit is closely related to an important basic concept in optics, viz. focal length. There is no definite distant limit for sharp reproduction by simple lenses and compound



Cover photo: Joh. Nautsch   Photo opposite: Bertil K. Johanson

A close-up photographer frequently encounters subjects which can only be photographed with the aid of a bellows accessory. The Hasselblad automatic bellows extension is then ideal. Lens, bellows and camera functions are interconnected with a twist of the wrist. The camera's release button is used for tripping the shutter and the camera's winding mechanism for advancing the film and winding the shutter. When the bellows extension is used with the 500EL/M, film advance and shutter winding are automatically carried out by the built-in motor.

Photo: Joh. Nautsch

The Hasselblad system now features 5 extension tubes in varying lengths. Tube lengths were selected to provide a nearly continuous range of extension when employed in conjunction with the available extension of the lens used. Extension tubes can be used intercombined in order to attain a desired scale of reproduction. As is the case with the automatic bellows extension, the extension tubes mechanically couple lens and camera mechanisms.

systems (such as camera lenses, for example) or by the normal eye. From a distance of a few feet (depending on the focal length) to an infinitely great distance, a sharp picture can be obtained at the focal plane. The greater the lens-to-subject distance, the smaller the picture. Even large objects are reproduced as small areas on the film. The longer the lens-to-subject distance, the smaller the subject reproduced on film. The subject-image ratio can be expressed in different ways. If a 2 in long object is reproduced 1 in long on the film, the scale is said to be 1:2, meaning that the scale of reproduction is one-half of the scale of the *subject*. A scale of 1:1 means that the scale of reproduction is equal to the scale of the subject. A scale of 2:1 means that the scale of reproduction is two times the scale of the subject.

The *close limit* defines the shortest possible distance for sharp reproduction. The optical system of the eye cannot alter its *image distance*, which is the distance between the central point of the crystalline lens (optical main plane) and the image plane (the retina). Instead, the dioptrics of the eye are adjusted for close-up vision brought about by *accomodation* (a change in the convexity of the anterior surface of the lens); in other words, the ability to refract light is increased by means of a corresponding reduction in the focal length. And this ability declines in man with advancing age.

The close limit can be demonstrated in a simple way. Look intently at a well lighted object with contrasting details (the page in front of you, for example), and bring the page slowly towards your eyes. Gradually a distance is reached when the printed letters begin to look blurred; that distance is the close limit for your eyes. A child of 10 with normal vision has a close limit of about 4 in, but by the age of 40 the close limit has reached about 10 in. The latter distance is usually regarded as the close limit of the eyes.

The camera lens also has a defined close limit but when adapting it to work at closer distances the adjustment is made by altering the image distance, i.e., the camera lens system is drawn forwards (or away) from the film plane.

The close limit can be shortened, both for the eye and the camera lens, by the use of different equipment.

There is only one way to reduce the close limit for your eyes and that is to place some optical system in front of them, such as eyeglasses, a loupe or microscope.

Shortening the close limit of a lens can be accomplished in the same way with the aid of an optical system. But an additional solution to the close-up problem is available to the photographer. The lens-to-filmplane distance can be extended, something you cannot do with the eye.

The two different methods are described below.

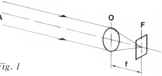


Fig. 1

Object (A) is at a long distance from the camera. The lens is focused on infinity. The lens (O) to film plane (F) distance is equal to the focal length of the lens (f).

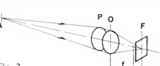


Fig. 2

Method 1. The degree of magnification can be increased by optical means using auxiliary lenses, i.e. Proxars. The lens-to-film plane distance is not altered in this method. The system's focal length is

reduced instead. You could say that distance (x) is optically extended, making it possible to reduce the lens-to-subject distance. See figure 2.

Fig. 3

Method 2. The degree of magnification is increased by reducing the distance to the object (A), i.e. the lens-to-subject distance. The distance (x) between the lens and film plane must then be increased if a sharp image is to be produced at the film plane. This extension can be obtained by turning the focusing ring of the lens, by using extension tubes or a bellows extension, the choice depending on the desired degree of magnification.

Close-up supplementary lenses

The positive lenses employed to reduce the closest focusing point of a lens for close-up work are usually referred to as close-up supplementary lenses. In the Hasselblad system they are called Proxars (from the Latin *proxime*=nearest). Their task is to reduce the focal length of the camera lens so you can move in closer to the subject and reproduce it on a larger scale on the film than would be possible with the unaided lens.

Information is required on the system's aggregate focal length in calculations of the scale of reproduction, the shortest lens-to-subject distans etc. This figure can not be obtained by simply adding the system's component focal lengths.

Other mathematics are necessary. All lenses or optical systems have a given "refractive power" or focal length which can be expressed in millimeters, centimeters or meters. Another way to express that power is in diopters. The advantage of the diopter system is that diopter values can be added when the total focal length of the aggregate system is to be determined.

Diopter values are obtained by dividing the focal length of the lens or supplementary lens in centimeters into 100. So the diopter value of an 80mm lens becomes $\frac{100}{8}=12.5$.

The diopter value of an 80mm Planar and a Proxar 0.5 ($\frac{100}{50}=2.0$) then becomes $12.5+2.0=14.5$.

The focal length in centimeters (cm) is obtained by dividing the diopter value into 100, i.e. $\frac{100}{14.5}=6.9$ Thus the focal length of this system is 6.9 cm=69 mm.

When the system's focal length is known, the classic optical equation can be used to calculate distance, extension and scale of reproduction.

Auxiliary lenses are a simple aid to use in close-up work. Thanks to the mirror reflex finder, the image on the camera's

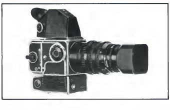


Photo: Caro Suisse

Determining the correct exposure can be a problem, especially since almost every photographer has his own subjective ideas about what is "correct" in any given situation. The exposure ultimately selected then becomes the result of light measurement tempered by the photographer's own judgement. The Hasselblad meter prism finder is an excellent aid in close-up photography since it automatically takes into account the light loss arising from increased extension.

focusing screen is completely parallax-free. Picture scales, picture areas, and other details of interest are provided in the tables in this booklet. However, the use of Proxar lenses alone cannot produce an unlimited range of picture scales. If all three Proxar lenses are combined with the 80mm Planar, the focal length is reduced to 63 mm and the maximum picture scale will be 1:2.5. A larger picture scale can be obtained by using more Proxar lenses of every power, or if converging lenses of higher dioptric numbers are attached to the Series 63 filter adapter ring. But since the quality of the image is degraded and the mechanical arrangements somewhat unsteady, this idea is not to be recommended. (On the other hand, Proxar lenses can be combined with the accessories below.)

Extension accessories

The possibilities of getting larger picture scales are very much improved when extensions are used. There is a choice of either extension tubes or the bellows extension.

Extension tubes 10, 16, 21, 32 and 55 provide extensions in millimeters equivalent to the type number of the tube. These tubes can be used in pairs, in combination or (in theory) several in conjunction, but if an extension greater than 2×55 mm is desired, then it would be better to use the bellows extension.

The *automatic diaphragm* mechanism in all Hasselblad lenses keeps the diaphragm wide open for maximum illumination of the focusing screen in focusing, examination of the image, and so on. The diaphragm automatically stops down to the preselected f/stop at the instant of exposure. Stopping down can also be accomplished manually to check on depth of field. This means that you always have the best possible control of the picture being taken, right up to the moment of exposure. A shaft in the extension tube connects to the camera's automatic diaphragm mechanism. Data on the different combinations are provided in the tables in this booklet.

The *bellows extension* permits *variable extension*, from 63.5 to 202 mm (2.5 to 8 in). This means that the smallest extension is 2.5 inches for all lenses when the distance scale is set at ∞. This explains why the picture scale with the 80mm Planar, for example, begins at about 1:1.3. The maximum extension in this case is 202 mm plus the extension possible at the lens itself, i.e. approximately 211 mm, equivalent to the scale 2.6:1.

The bellows extension has two different rack-and-pinion systems. The upper system regulates bellows draw, the lower is attached to a quick-coupling rail with a tripod socket. So the entire photographic system can be shifted in relation to the tripod without altering extension.

Photo: Fridmar Damm

Nature is replete with beauty, even on a small scale. A simple accessory may be all you need to photograph that beauty. Proxars are small and light enough to fit any equipment bag. They are also easy to work with, since they require no exposure compensation. Proxars can be used in combination with one another in order to increase the scale of reprocuction.

It is possible to set the bellows for a predetermined scale and then, using the lower track, make a fine adjustment in focus without disturbing the position of the base frame. This arrangement is especially useful when the picture scale is large because whenever the frame and the entire camera assembly have to be moved, focusing has to be repeated to compensate for the change in extension; much time is saved and the desired picture scale is retained.

The bellows has a scale displaying the extension in cm and a scale showing the light value reduction in steps for the 135mm f/5.6 S-Planar C lens.

Since the camera body mechanism and lens mechanism are interconnected via the bellows, all winding and triggering take place on the camera as usual. So you work in the same way as if the lens were directly attached to the camera body.

Exposure increase

When extension is increased, the light passing through the unchanged diaphragm has to cover a larger distance, making the diaphragm scale on the lens inaccurate. Therefore, exposure must be increased when the lens extension is employed since light intensity declines with the square of the distance.

Example: Exposure data are known for a setup with 4 in of extension. If this extension is increased to 8 in (i.e. doubled), the exposure must be increased by a factor of $2^2=4$ since light intensity falls off with the square of the distance. Somewhat confusingly, this factor of 4 means that the diaphragm must be opened two more stops (or that an equivalent change is made in shutter speed). The mathematics of this operation are due to the fact that every f/stop increase admits twice as much light. To reduce this confusion, the diagram at the back of this booklet states exposure increases in steps. Exposure increases noted in the nomograms at the back of this booklet are noted in *steps*, i.e. f/stops or equivalent shutter speed changes. A tripod is often employed in close-up work, making it possible to use slower shutter speeds. However, slow shutter speeds may not be appropriate for moving subjects.

Depth of field

Theoretically speaking, a sharp picture can only be obtained with a lens focused on a given distance from the object. Small details, closer or further away, are only recorded less sharply on the film plane (but sharply either before or behind this plane). A certain, defined point in the vicinity of the focused distance thus grows into and is recorded on the film as a small, diffused patch, the *circle of confusion*.

A point, however, has no dimensions theoretically. However, if such a point is slowly allowed to grow into a little circle, it can first be perceived by the naked eye when it is about $^1/_{20}$ to $^1/_{30}$ mm in diameter. We can, of course, accept the fact that the circle of confusion is of the same size, and this means that the focus set is acceptable for the object distance involved anywhere within the narrow compass of this zone. This zone is known as the depth of field of the lens.

Dept of field is always shallow in close-up work and varies in symmetry. If extension is slight, depth of field behind the focusing point is greater than the field in front of that point. Depth of field becomes far more symmetrical when extension is increased but always declines as the scale of reproduction increases. For this reason a small f/stop, providing greater depth of field, should always be used for close-ups. However, the lens should never be stopped down all the way, since this has an adverse effect on sharpness in close-ups. Depth of field can be checked on the focusing screen prior to exposure by using the camera's depth-of-field preview catch. But the lens should always be focused wide open for the sake of maximum focusing accuracy.

Photo: Bo Timback

The nearly unlimited interchangeability of Hasselblad system components makes it possible to tailor the camera to the job and to alter function and capability in a matter of seconds. In this picture, the roll film back has been replaced with a magazine for Polaroid film. This self-developing film is a fantastic asset in situations in which a check on composition, depth of field etc. is desired before the final take on conventional film.

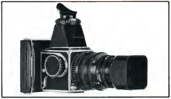


Photo: Jens Karlsson

One of the lenses in the Hasselblad system, the 120mm f/5.6 S-Planar, is especially designed for close-up photography. Its relatively long focal length yields a convenient lens-to-subject distance, both with the bellows extension and extension tubes. The lens design results in maximum resolution and image brilliance. A lens shade must be employed to make the most of the optic's performance. The Professional is the most efficient Hasselblad lens shade.

Selecting a lens

The basic principle in the selection of lenses is that all lenses, from normal focal lengths to telephotos, can be used for close-up photography. Lens makers generally advise against using an extension tube with shorter than normal focal lengths lenses. In the Hasselblad system, this would mean that lenses with focal lengths less than 80 mm would be ruled out for close-up work. However, there are usually exceptions to every rule, even this one. One such exception is the 50mm f/2.8 Distagon F whose optical design and floating element make it a macro lens in practice. When set at its closest focusing point—the subject then only about 5 in from the front lens element—the lens covers a field size of only 5×5 in.

Another exception involves the photographer's freedom in the choice of accessories. Many photographers have obtained exciting and unusual pictures by combining a short focal length lens with e.g. a 10mm extension tube. However, if you disregard the advice of lens makers in this way, you will have to accept some loss of image quality at the corners of the field. This is unimportant with many subjects. Still, 80 mm or longer focal lengths remain the normal choice for close-ups.

People who frequently work in the close-up range should select one of the lenses especially designed for close-up work, i.e. the 120mm f/5.6 or the 135mm f/5.6 Zeiss S-Planar C lenses.

Suitable focal length

Thus, the 80mm focal length is the shortest focal length used in practice in close-up photography with a Hasselblad. The main advantage of utilizing this short focal length is the ability to attain a very large scale of reproduction or magnification. The inevitable light loss in work with extension tubes or a bellows is also less with the 80mm lens than with longer focal length. A disadvantage is the fact that you have to work closer to the subject than with longer focal lengths lenses in order to obtain the same degree of magnification.

This can be illustrated by comparing the 80mm f/2.8 Planar with the 150mm f/4 Sonnar.

Assume that an object is to be reproduced at a scale of 1:1, i.e. life-sized. With the 80mm focal length, the object must be located approx. 4³/₄ in from the front lens element and the exposure has to be increased by 1.5 f/stops to compensate for the light loss. With the 150mm lens, the object must be placed about 11³/₄ in from the front lens element in order to attain the same scale of reproduction. Here, the exposure must be increased by 2.5 f/stops to compensate for the light loss. An interesting point is that the depth of field is exactly the same in both cases, i.e. 2 mm (0.080 in) at f/11.

Special lenses

Most camera systems feature special close-up lenses, often with focal lengths close to the camera's normal focal length (50 mm for 35mm cameras and 80 mm for 2¹/₄×2¹/₄).

Hasselblad has selected medium-long focal lengths for its close-up lenses, i.e. 120mm and 135mm. These focal lengths provide a convenient lens-to-subject distance. In contrast to other lenses corrected for optimum performance at long working distances, these lenses feature optimum correction in the close-up range from about 10 ft and less. They also yield excellent results at longer working distances if closed down a few stops. When used for close-up, their performance is outstanding, even without being stopped down.

The special Hasselblad close-up lenses are the 120mm f/5.6 S-Planar C, which can be used on the camera body or with extension tubes, and the 135mm f/5.6 S-Planar C which always has to be used in combination with the bellows exten-

sion. The special optical properties of these lenses are such that the lenses should not be used with Proxar supplementaries.

A special lens is an obvious choice for specialists in close-up photography. People who only take close-ups occasionally have a wide range of suitable lenses to choose from with focal lengths from 80 mm to 500 mm. (See "Perspective" regarding the use of longer focal lengths 250, 350 and 500mm lenses in combination with extension tubes.) Two of these lenses have speeds very useful to close-up photographers. They are the 110mm Planar F with an f/2.0 maximum aperture and the 150mm Sonnar F with a maximum aperture of f/2.8. Both are designed for the Hasselblad 2000FC. The combination of a high speed and long focal length results in a bright focusing screen image and very exact focusing.

Choice of shutter

There is one inevitable problem in close-up photography: the need to use the smallest possible f/stop in order to obtain the greatest possible depth of field while using the fastest possible shutter speed to reduce blurring due to subject and/or equipment motion. In many cases, a suitable compromise is impossible without flash.

Most advanced cameras on the market have focal plane shutters, making flash synchronization only available at 1/90 s, 1/60 s etc., i.e. speeds at which the shutter curtains are completely out of the light path. Ghost images can result from the use of these relatively slow shutter speeds since the flash produces the main illumination in only 1/1000 s or less. But if the shutter remains open for 1/90 or 1/60 s even the ambient lighting may have time to expose the film. Or the subject, such as a flower, insect or the like, may have

Photo: Bertil K. Johanson

time to move. The result is a degrading of the sharp main image by a ghost image resulting from the slow shutter speed.

The problem can only be solved with a leaf shutter. Synchronized flash shots taken at speeds down to 1/500 s can be employed with this shutter type. 1/500 s is slow enough to capture all the light emitted by the flash but fast enough to prevent any image-blurring motion or ambient lighting "ghosts."

All the lenses for the Hasselblad 500C/M and the 500EL/M have between-the-lens leaf shutters. These lenses can also be used without restrictions on the 2000FC. So a leaf shutter is preferable in work with flash. A focal plane shutter may be preferable in other lighting and when slow shutter speeds are needed. (See "Extreme close-ups.")

Perspective

Most close-ups are taken with lenses with focal lengths between 80 and 150 mm, but there is nothing to prevent the use of even longer focal lengths. With an extension tube and long focal length lens, the ensuing perspective can yield exciting images or the best rendition of a subject. Joh. Nautsch provides an example of this in the picture on page 17. He was able to get sufficiently close to the main subject by using a 350mm f/5.6 Tele-Tessar and the 3 in (76 mm) of extension provided by the 21mm plus 55mm extension tubes. The long focal length of this lens and its narrow angular field compress the perspective perceived from normal viewing distances and the setting sun in the background attains enormous dimensions.

Animal photographers also frequently use extension tubes on telephoto optics. These photographers are familiar with animal behavior. They are also familiar with the approximate working distance required to fill the image format and select equipment accordingly. When bird's' nests are the subject, the use of an extension tube may also be suitable in obtaining the correct framing. By way of example, the 500mm f/8 Tele-Tessar has a closest focusing point of 28 ft; it then covers a field of about 31×31 in. With the 55mm extension tube, its shortest lens-to-subject distance drops to 13 ft and the field size to 11×11 in. The corresponding values with the 21 mm extension tube are $18^{3}/_{4}$ ft and 19×19 in.

A long focal length lens and extension tubes can also be employed in recording inaccessible details in architectural photography.

It may be difficult to obtain format-filling images of small and medium-sized objects with good perspective because of the need to shoot so close to the subject. However, the working distance can be extended and perspective altered by using a long focal length lens with an extension tube.

Viewfinders

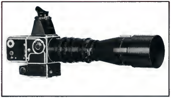
In close-up photography, viewfinders with a sighting angle of 45° and 90° are most suitable. The standard focusing hood with the built-in magnifier is therefore an excellent choice.

The magnifying hood, whose eyepiece is replaceable with a prescription lens for eyeglass wearers, has many advantages. It yields a viewfinder image magnified 2.5 times and effectively excludes extraneous light from the side. This may be important in work with long extension since the viewfinder image can then be dim.

The ideal viewfinder for close-up photography and, in fact, for most other photographic applications is the meter prism finder. It has a convenient 45° sighting angle and displays an unreversed image magnified 3 times. The built-in exposure meter is a real asset when you work with a bellows extension and extension tubes. It measures the light striking the focusing screen and displays a reading which can be transferred to the lens without any calculations.

Photo: Joh. Nautsch

A photographer's ability to combine various image elements and equipment items determines whether a picture is good, bad or indifferent. A 55mm + a 21mm extension tube made it possible to reproduce the blades of grass on a large scale. The long focal length of the 350mm lens yields a narrow angular field and apparently compressed perspective.



Extreme close-ups

The most extreme close-ups are obtained by photographing through a microscope. However, photomicrography is beyond the scope of this booklet.

But a Hasselblad camera can be set up so it serves as a complete microscope in itself. It is then possible to obtain magnifications up to 40 times, i.e. an object which is about 1.4×1.4 mm (0.055 in) fills the entire $2^1/_4 \times 2^1/_4$ (6×6 cm) format when photographed. Luminar lenses manufactured and marketed by Carl Zeiss are the means of obtaining this end. These special-purpose lenses, available in focal lengths from 16 mm to 100 mm, can be fitted to a Hasselblad 500C/M, 500EL/M and 2000FC with the aid of an adapter which has to be made to order.

The extremely long extensions required are obtained by combining the Hasselblad automatic bellows with extension tubes. The long extension and relatively slow speed of the Luminars often result in rather long exposures if incandescent microscope lamps are the source of illumination. When shutter speeds longer than 1 s are necessary, exposures can be made with the camera's auxiliary shutter in the 500C/M and 500EL/M. With the 2000FC exposures are made with the camera's focal plane shutter which, with the aid of the shutter speed multiplier, has a working range from 1/30 s to 60 s.

The short distance from the subject to the front lens element can be a problem when Luminar lenses are employed. One solution to the problem is to surround the subject with a "tent" made of reflective material. The lens is inserted through an opening in the roof of the "tent". Light is aimed in through an opening in the side of the "tent" and bounced off the "tent" walls so the subject can be photographed in indirect, diffused light.

Light

Mastery of lighting is one of the most important requirements for a good picture. This is especially the case in close-ups outdoors or in the studio. Outdoors, every effort is usually made to utilize existing light. Shooting angles must be sought with front lighting and back lighting until an angle is obtained with the best lighting.

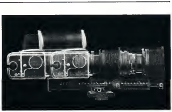
The "best" lighting is lighting which brings out and underlines the characteristics of the subject.

But the lighting may often be too weak and different aids must then be used. Sheets of white cardboard close to the subject but outside the field of view may suffice for stationary subjects. The cardboard can be supplemented with a shiny reflector at a more brightly illuminated site than the subject. The reflector is then used to reflect light onto the subject.

Excellent commercial reflectors are available on the market, but it is easy to make

Photo: Joh. Nautsch

The 135mm f/5.6 S-Planar is a special-purpose lens designed for use with the bellows extension. This macro combination yields continuous focusing from 21 in (a 1:1 scale of reproduction) to infinity. The automatic bellows extension has a tripod quick-coupling making it possible to shift the camera–bellows extension–lens in relation to the subject without shifting the tripod.



one yourself. Aluminum foil glued onto a sheet of cardboard will do just fine. There are different opinions about the most suitable reflecting surface. Some people prefer the contrasty light reflected from a smooth, shiny surface. Others wrinkle the foil before it is glued so that softer light is reflected. Reflectors are equally useful outdoors and in the studio.
Moving subjects outdoors should always be photographed with flash (see "Choice of shutter"). The ringlight provides even, shadowless lighting and is especially suitable when working with a large scale of reproduction with the lens close to the subject.
Light aimed low and from the side, resulting in shadows, is preferable when the surface structure of the subject is to be brought out.
In certain instances an intense beam of light aimed low across the surface of the subject from the side may be required. A point light source is desirable here and can be obtained with a microscope lamp, spotlight or an ordinary projector. A small flash unit located as far from the subject as possible also produces light comparable to a point light source. The hard shadows produced by a point light source can be filled in and softened with a reflector.
The use of an extra fill-in lamp or flash to soften shadows can easily give rise to intrusive reflections.

Choice of film

Color film is far and away the best choice for close-ups in nature. The shallow depth of field obtained with large f/stops often blurs the background and foreground into harmonious patches of color. The shape and color of the subject distinguish it from the surroundings.
With black & white film, the harmonious colors seen in the viewfinder often end up as featureless, gray patches which partially obscure details you would like to bring out. An experienced black & white photographer never falls into this trap and stops thinking in terms of color. His image is composed by shape and contrast, highlights and shadows.
Factors such as these can also be employed with color film, but here an extra dimension is yielded by color. The image seen on the focusing screen is the image you will obtain on the film. The use of high speed color films may be practical, especially in natural light. High speed films make it possible to use fast shutter speeds, essential in eliminating motion blurring, and the small apertures required for the necessary depth of field. The disadvantage of these films is their relatively coarse grain and the impaired resolution caused by that graininess. However, this circumstance is by no means the same adverse factor with the large $2^1/_4 \times 2^1/_4$ Hasselblad format as it is with 35 mm, only about a fourth as large.

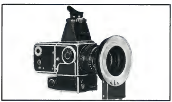
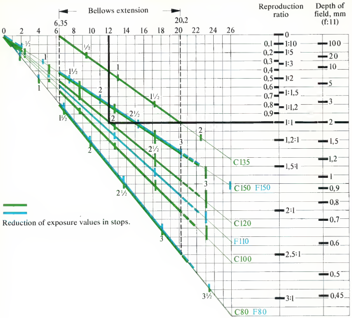


Photo: Joh. Nautsch

Natural lighting almost always provides the best rendition of a subject but can be a problem in work with long extension. The ringlight may then be a valuable accessory. It permits even, shadowless lighting and is particularly suitable in photography with a large scale of reproduction. It can be used as the main light source or as a supplement to daylight. Hasselblad lenses with fully synchronized shutters add an extra dimension to flash photography.

Photo: Jens Karlsson

One characteristic of successful photographers is constant alertness and constant readiness. They know that picture opportunities can turn up without warning and perhaps never return. The picture left shows a truly well-equipped photographer. The automatic bellows extension with a 135mm S-Planar lets you take pictures at a scale of 1:1 but still enables you to quickly switch to work at long lens-to-subject distances. The Hasselblad 500EL/M features rapid motorized film winding and a rapid-return mirror. The Magazine 70 holds 70 frames per load.



Diagram

The C lenses in the diagram are represented by green lines, the F lenses by blue lines and extension by the horizontal centimeter scale. The centimeter scale coincides with the bellows only when the lens is focused at ∞. This extension is indicated in the diagram with green and blue dashed extensions respectively of the slanting lines. Light value reduction in steps is noted with green and blue markings and numerals.

Example: The example is designated with a bold black line in the diagram and assumes the use of a 120mm f/5.6 S-Planar C optic and 12 cm (4¾ in) of extension.
Follow the vertical black line down to the slanting green C120 line and then across to the right. This leads you to the following values: light value reduction 2 steps, reproduction ratio 1:1, depth of field at f/11 2 mm (0.080 in).

Which equipment to choose?

Suitable equipment for close-up photography is found in the nomograms. Each nomogram is to be read vertically up and down. The short horizontal whole and dotted lines* indicate the working range for specific equipment used in conjunction with the focusing mount of the camera lens. The left end indicates values when the lens is set at infinity. The right end indicates values with maximum built-in lens extension. The nomogram also shows when the bellows extension begins to replace extension tubes. Whole lines represent C lenses, dotted lines F lenses.

Example: Find the nomogram for the 120mm f/5.6 S-Planar C with an extension tube 55. Draw two vertical lines across the entire nomogram from the left to the right ends respectively of the line designated 55. The points at which these lines intersect the scale for "Length of subject side" are at approx. $4^3/_4$ in and $3^1/_4$ in. Thus, the subject fields from $3^1/_4 \times 3^1/_4$ up to $4^3/_4 \times 4^3/_4$ can be covered with this setup.

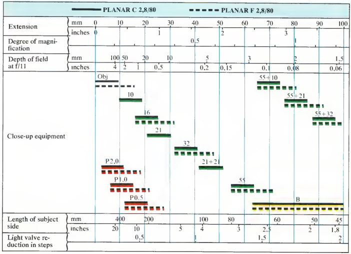
The following information is obtained at the other intersection: magnification: 0.47 and 0.65; light value reduction: approx. 1 step and 1.3 steps; depth of field: approx. 0.26 and 0.16 in.

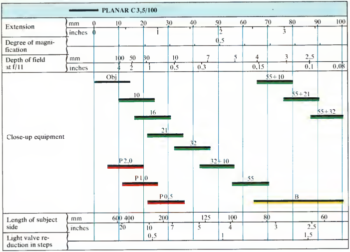
Depth of field is stated for f/11. Depth of field is doubled at f/22 and halved at f/5.6. Determine the light value for your exposure and reduce this value by the value indicated for "Light value reduction in steps" as found in the nomogram.

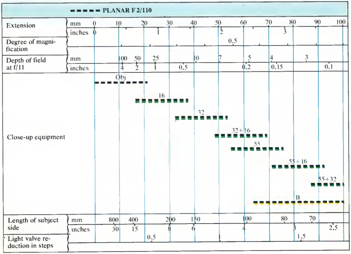
When a Proxar is used on the camera lens, a new optical system is created with a shorter focal length than the nominal focal length of the camera lens. So only the scales for magnification and depth of field are of any pertinence. The scale for "Length of subject side" indicates the approximate value. No light value reduction is necessary.

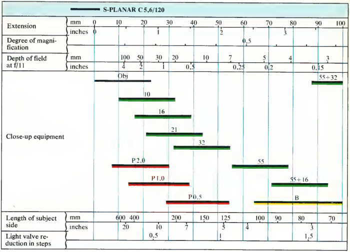
***Symbols employed**

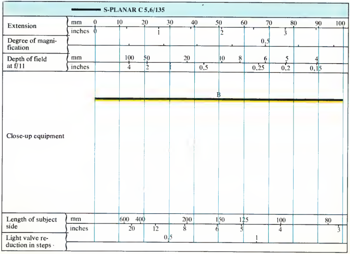
- C-lenses
- F-lenses
- Proxar auxiliary lenses
- Extension tubes
- Bellows extension

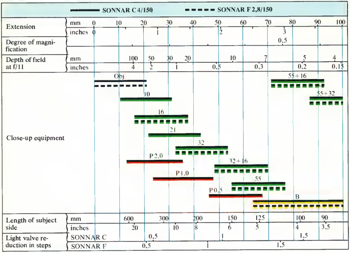


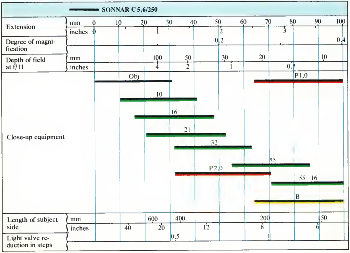

PLANAR C 3,5/100
Extension
mm 0 10 20 30 40 50 60 70 80 90 100
inches 0 1 2 3
Degree of magnification
0,5
Depth of field at f/11
mm 100 50 30 10 7 5 4 3 2,5
inches 4 2 1 0,5 0,3 0,15 0,1 0,08
Close-up equipment
Obj
10
16
21
32
P 2,0
P 1,0
P 0,5
32+10
55
55+10
55+21
55+32
B
Length of subject side
mm 600 400 200 125 100 80 60
inches 20 10 7 5 4 3 2,5
Light valve reduction in steps
0,5 1 1,5


PLANAR F 2/110
Extension
mm 0 10 20 30 40 50 60 70 80 90 100
inches 0 1 2 3
Degree of magnification
0,5
Depth of field at f/11
mm 100 50 25 10 7 5 4 3
inches 4 2 1 0,5 0,2 0,15 0,1
Close-up equipment
Obj
16
32
32+16
55
55+16
55+32
B
Length of subject side
mm 800 400 200 150 100 80 70
inches 30 15 8 6 4 3 2,5
Light valve reduction in steps
0,5 1,5


S-PLANAR C 5,6/120
Extension
mm 0 10 20 30 40 50 60 70 80 90 100
inches 0 1 2 3
Degree of magnification
0,5
Depth of field at f/11
mm 100 50 30 20 10 7 5 4 3
inches 4 2 1 0,5 0,25 0,2 0,15
Close-up equipment
Obj
55+32
10
16
21
32
P2.0
55
P1.0
55+16
P0.5
B
Length of subject side
mm 600 400 200 150 125 100 90 80 70
inches 20 10 7 5 4 3
Light valve reduction in steps
0,5 1 1,5


S-PLANAR C 5,6/135
Extension
mm 0 10 20 30 40 50 60 70 80 90 100
inches 0 1 2 3
Degree of magnification
0,5
Depth of field at f/11
mm 100 50 20 10 8 6 5 4
inches 4 2 1 0,5 0,25 0,2 0,15
B
Close-up equipment
Length of subject side
mm 600 400 200 150 125 100 80
inches 20 12 8 6 5 4 3
Light valve reduction in steps
0,5 1


SONNAR C 4/150
SONNAR F 2,8/150
Extension
mm 0 10 20 30 40 50 60 70 80 90 100
inches 0 1 2 3
Degree of magnification
0,5
Depth of field at f/11
mm 100 50 30 20 10 7 5 4
inches 4 2 1 0,5 0,3 0,2 0,15
Close-up equipment
Obj
55+16
10
55+32
16
21
32
P 2,0
32+16
P 1,0
55
P 0,5
B
Length of subject side
mm 600 300 200 150 125 100 90
inches 20 10 8 6 5 4 3,5
Light valve reduction in steps
SONNAR C 0,5 1 1,5
SONNAR F 0,5 1 1,5


SONNAR C 5,6/250
Extension
mm 0 10 20 30 40 50 60 70 80 90 100
inches 0 1 2 3
Degree of magnification
0,2 0,4
Depth of field at f/11
mm 100 50 30 20 10
inches 4 2 1 0,5
Close-up equipment
Obj
P 1,0
10
16
21
32
55
P 2,0
55+16
B
Length of subject side
mm 600 400 200 150
inches 40 20 12 8 6
Light valve reduction in steps
0,5 1

HASSELBLAD®

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